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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/542,951	07/21/2005	**Ali Kaan Kalkan**	PST-29202/36 (PATENT)	2017

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EXAMINER	
LANGMAN, JONATHAN C	

ART UNIT	PAPER NUMBER
1794	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/542,951	KALKAN ET AL.	
	Examiner	Art Unit	
	JONATHAN C. LANGMAN	1794	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 January 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *99-115* is/are pending in the application.

4a) Of the above claim(s) *112-115* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *99-111* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 July 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/21/2005 and 10/28/2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Applicant's election of Group I, Claims 99-111 in the reply filed on January 22, 2009 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claims 112-115 withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected group, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on January 22, 2009.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 105 and 107-111 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The applicant claims "wherein one of said plurality of metallic nanocrystals bridges two spatially separated adjacent columns of said array of nanostructured columns". The applicant has not pointed to,

and the Examiner was unable to find, support for this limitation in the originally filed specification.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 99, 101-104 and 106 are rejected under 35 U.S.C. 102(e) as being anticipated by Filas et al. (US 6,741,019).

Filas et al. teach Silicon or semiconductor nanowires with diameters between 0.5 and 50 nms (col. 3, lines 1-15). As seen in figure 2b, the nanowires are coated with a magnetic material and drawn to a substrate in order to align the nanowires orthogonally to the substrate (nano columns) (col. 3, lines 18-55). A liquid carrier comprising nanoscale particles of metal such as Ag, Cu, Ni, Fe, and Au, are added to the magnetic coated semiconductor nanowires and deposited onto a substrate. The mixture is then decomposed, sintered or cured (col. 11, lines 1-30). The nanowires have lateral space alignment as seen in the figures (col. 9, lines 30-35).

Claims 99, 103, and 104 are rejected under 35 U.S.C. 102(b) as being anticipated by Sun et al. "Surface Reactivity of Si Nanowires".

Regarding claim 99, Sun et al. teach the use of silicon nanowires (SiNW's) used for their properties such as electron field emission (6396, col. 1, 3rd paragraph). Sun teach Silicon nanowires with diameters of approximately 20 nms (page 6396, col. 2, 2nd paragraph). The SiNW's were immersed in a metal salt solution comprising silver or copper, upon which nanoparticles of the metal deposited onto the sidewalls of the Silicon nanowires (see figures and pg. 6397, Section III B). The nanowire solutions were mounted onto a substrate (pgs. 6396-6397, Section II).

Regarding claim 103, Sun teaches that first the SiNW's are stripped of their oxide through an HF etch, however during the reductive deposition of the metal nanoparticles, the surface oxide is reformed on the silicon nanowire (pg, 6398, col. 2, first paragraph). This reoxidation reads on the instantly claimed three dimensional surface having an oxide layer underlying said plurality of metallic nanocrystals.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 100 is rejected under 35 U.S.C. 103(a) as being unpatentable over Filas et al. (US 6,741,019) in view of Debe (US 5,726,524).

Filas et al. teach a structure as described above. Filas teach mounting the structure to a substrate 76 (Figure 6), however are silent to what material the substrate is. Filas et al. are silent to the substrate being glass. However it is known in the art, and taught by Debe, that for Field Effect transistors glass is a suitable substrate (see col. 8, lines 25-30 and col. 14, lines 40-45, for instance).

Claims 101-102 are rejected under 35 U.S.C. 103(a) as being unpatentable over Filas et al. (US 6,741,019).

Filas et al. teach that the nanowires are aligned in an orthogonal manner and spaced apart from each other as seen in the figures (also see col. 9, lines 30-40). Filas et al. are silent to the specific spacing dimensions, i.e., 20 nms apart. However, it would have been obvious to one having ordinary skill in the art at the time of the invention to adjust the spacing to within those ranges instantly claimed, for the intended application, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Claims 99-102, 104 and 106 are rejected under 35 U.S.C. 103(a) as being unpatentable over Debe (US 5,726,524).

Regarding claims 99, and 104, Debe teach an electric field emission device comprising a substrate, with a dense array of discrete solid microstructures. The microstructures are overcoated with an electron emitting material (abstract). The

microstructure is taught to be nanorods (col. 8, lines 1-7), with a diameter of 10 to 500 nms (col. 7, lines 55-62). The nanorod material is taught to be semiconducting material, and is also taught to be silicon (col. 12, lines 20-26). Although Debe does not teach specific examples of the microstructure diameter, lengths, and material as those instantly claimed, they are taught in Debe and would have been obvious choices to a routineer in the art due to their disclosure in Debe.

The overcoated electron emitting material is taught in examples to be Pt (col. 14). However, this material can be any of those materials instantly claimed (col. 12, lines 10-20). The coating nucleates into nanometer sized islands on top of and on the sides of the whiskers or nanorods (col. 13, lines 45-50, also see figures 2A-2C).

The process for coating includes dip coating (immersion) coating and electroless plating similar to those taught by the applicant (col. 13, lines 10-30).

Regarding claim 100, the substrate is preferably glass (col. 8, line 30).

Regarding claim 101, Debe teaches a dense array of microstructures. According to Debe, a dense array means "wherein preferably the mean spacing is approximately equal to the mean diameter of the microstructures (col. 4, lines 45-50). Since Debe teaches the same diameters as instantly claimed (greater than 10 nms), then the range of spacing is greater than 10 nms wherein the instantly claimed range of 20 nms falls within this range.

Regarding claim 102, Debe teaches that the height of the microstructures are 1000 angstroms to 5 microns (col. 7, lines 50-57), wherein the instantly claimed length falls within this range.

Regarding claim 106, Debe teaches that the tops of the microstructures are coated heavier than the sidewalls of the nanorods (col. 14, lines 10-20). It is inherent that this effect results in nanocrystals sized on the order of the wavelength of visible light and impacts a bulk metallic reflectance to the composition. ,

Claims 101, 102, 105, 106, and 107-111 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sun et al. "Surface Reactivity of Si Nanowires" as applied to claims 99, 103, and 104 above, in view of Zhang et al. ("Synthesis of Ordered Single Crystal Silicon Nanowire Arrays").

Sun teaches a method of making metal nanoparticles by the use of SiNW's to reduce the metal salt solutions, which in turn deposit nanoparticles of the material onto SiNW's, as discussed above. Sun uses SiNW's that are fabricated by laser ablation techniques. Sun does not teach a technique that will result in a densely packed array of SiNW's.

Zhang et al. teach SiNW's fabricated by laser ablation often results in curved and tangled SiNW's, which hampers the application of these SiNW's. Zhang proposes a template method of forming densely arrayed SiNW's on the order of greater than 10^7 tips/cm^2 (Zhang 1st paragraph). The method actually achieves SiNW's of 10^{10} tips/cm^2 with equal height, uniform diameter, and perpendicular growth to the substrate (3rd paragraph). Zhang also successfully formed SiNW's with a diameter of 22 nms, falling within the instantly claimed range (pg 1239 col. 2, paragraph 2).

A routineer in the art would have appreciated Zhang's SiNW template as an alternative to the laser ablation SiNW's of Sun, since Zhang's technique results in a dense array of Nanowires, which will allow for more sites of reduction of metal salt to metal nanoparticles as taught by Sun. A routineer in the art would have appreciated Zhang's work in that It would have been obvious to a person having ordinary skill in the art at the time the present invention was made in order to gain also allow for a better control of the diameter of the nanoparticles, since they would be limited to the interspacing of the nanowires.

It would have been obvious to a person having ordinary skill in the art at the time the present invention was made to use the SiNW template formation technique of Zhang as an alternative to the laser ablation technique taught by Sun et al., as Zhang has shown that this technique results in densely packed arrays of perpendicular SiNW arrays for the ease of application in the art.

It would have been obvious to a routineer in the art to combine prior art elements of Zhang, and Sun, according to known methods, in order to yield predictable results such as more nucleation sites for the reduced metal nanoparticles, and better control of diameter size (MPEP 2141 [R-6], KSR International Co. v. Teleflex Inc. (KSR), 550 U.S. ___, 82 USPQ2d 1385 (2007)).

Regarding claims 101 and 102, Zhang goes on to teach that the nanowire diameter and length depend on the pore diameter and growth time of the nanowire. Zhang teaches that the pore diameter and pore density in the templates is easily adjusted. It would have been obvious to a routineer in the art, to adjust the pore

diameter and density, to obtain a desired nanowire diameter and nanowire spacing; furthermore, it would have been obvious to adjust the growth time, in order to adjust the length of the nanowires. It would have been obvious to one having ordinary skill in the art at the time of the invention to adjust the known parameters for the intended application, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claims 105, and 107-110, Sun teaches the same deposition methods to obtain copper and silver ions on Silicon nanowires. Sun does not teach that the silicon nanowires have a specific length or a specific spacing. Zhang overcomes these deficiencies by a new growth technique of SiNW's that results in perpendicular SiNW's with dense spacing's, and obviously modified lengths. When using the template grown SiNW's of Zhang, with the obvious designs of desired spacing, diameter sizes, and lengths, in the nanostructure of Zhang, one would inherently and expectedly arrive at the instantly claimed structure wherein one of the plurality of nanoparticles bridges two silicon nanowires. It has been held that where the claimed and prior art products are identical or substantially identical in structure or are produced by identical or a substantially identical processes, a prima facie case of either anticipation or obviousness will be considered to have been established over functional limitations that stem from the claimed structure. *In re Best*, 195 USPQ 430, 433 (CCPA 1977), *In re Spada,* 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). The ***prima facie*** case can be

rebutted by evidence showing that the prior art products do not necessarily posses the characteristics of the claimed products. *In re Best*, 195 USPQ 430, 433 (CCPA 1977).

Regarding claims 106 and 111, since Sun teaches the same deposition techniques as instantly claimed. When a routineer in the art as described above, obviously uses the Zhang substrate with the deposition techniques of Sun, the instantly claimed properties would inherently be present. See in re best case law presented directly above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JONATHAN C. LANGMAN whose telephone number is (571)272-4811. The examiner can normally be reached on Mon-Thurs 8:00 am - 6:30 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer McNeil can be reached on 571-272-1540. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JCL

/Timothy M. Speer/
Primary Examiner, Art Unit 1794